portion where said first member and said electrode abut with each other, said first film and said low resistive film being in contact with each other.

84. (New) The electron beam apparatus according to claim 26, wherein said electron source includes cold cathode devices as an electron emission device.

REMARKS

This application has been reviewed in light of the Office Action dated July 3, 2001. Claims 1-84 are now presented for examination. New Claims 43-84 have been added to provide Applicants with a more complete scope of protection. Claims 1, 26, 27, and 43-51 are in independent form. Favorable reconsideration is requested.

The specification and abstract were objected to for the reasons given on pages 2 and 3 of the Office Action. The specification and abstract have been carefully reviewed and amended as to matters of form, as deemed necessary to overcome those objections, and thus the withdrawal of those objections is respectfully requested.

Applicants note with appreciation the indication that Claims 10 and 35 would be allowable if rewritten so as not to depend from a rejected claim, and with no change in scope.

Claims 1-3, 5, 6, 19, 27-29, and 31 were rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art in view of U.S. Patent No. 5,939,822 (Alderson). Claims 7-9, 11, 32, 33, 34, and 36 were rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art in view of Alderson and further in view of U.S. Patent 6,222,313 (Smith et al.). Claims 4, 12, 13, 16-18, 20-26, 30, 37, 38, 41, and 42

were rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art in view of Alderson and further in view of U.S. Patent 5,760,538 (Mitsutake et al.). Claims 14, 15, 39, and 40 were rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art in view of Alderson and further in view of U.S. Patent No. 5,811,919 (Hoogsteen et al.).

Independent Claim 1 recites:

"An electron beam apparatus comprising a hermetic container which includes an electron source having electron emission devices and targets exposed to the electrons emitted from the electron source and further comprising a first member within said hermetic container. The value of the incident angle multiplication coefficient of secondary electron emission coefficient m_0, which is a parameter of the following formula:

$$\frac{\delta_0}{\delta_0} = \frac{1 - \left\{ 1 - \dfrac{m_0 \cos\theta}{1 + (m_1) \times (m_0 \cos\theta)^{m_2}} \right\} \exp(-m_0 \cos\theta)}{1 - \left\{ 1 - \dfrac{m_0}{1 + (m_1)^{-1} \times m_0^{m_2}} \right\} \exp(-m_0)} \times \frac{1}{\cos\theta}$$

General Formula (1)

is 10 or less,
when obtaining it from the value of secondary electron emission coefficient measured under the conditions that incident energy is 1 k eV and incident angle is 0 degree as well as the values measured under the conditions that incident energy is 1 k eV and incident angles θ are 20, 40, 60 and 80 degrees by conducting a regression analysis by the least square method in said general formula (1), provided that the second electron emission coefficient of the surface of said first member has two incident energies which satisfy the second electron emission coefficient δ = 1 under the vertical incident conditions. and that when the larger energy of the above two energies satisfying δ = 1 is referred to as a second cross-point energy, the secondary electron emission coefficients for the primary electrons whose incident angles are 0 and 0 degrees are represented by

δ_0, δ_0, respectively, and
m_1, m_2 have the values
m_1 = 0.68273
m_2 − 0.86212, respectively.

in the incident energy equal to or lower than the second cross-point energy."

Independent Claim 27 is directed to a spacer, and recites:

"27. A spacer, wherein the value of the incident angle multiplication coefficient of secondary electron emission coefficient m_0, which is a parameter of the following formula:

$$\frac{\delta_\theta}{\delta_0} = \frac{1 - \left\{1 - \dfrac{m_0 \cos\theta}{1 + (m_1)^{-1} \times (m_0 \cos\theta)^{m_2}}\right\} \exp(-m_0 \cos\theta)}{1 - \left\{1 - \dfrac{m_0}{1 + (m_1)^{-1} \times m_0^{m_2}}\right\} \exp(-m_0)} \times \frac{1}{\cos\theta}$$

General Formula (1)

is 10 or less,
when obtaining it from the value of secondary electron emission coefficient measured under the conditions that incident energy is 1 k eV and incident angle is 0 degree as well as the values measured under the conditions that incident energy is 1 k eV and incident angles θ are 20, 40, 60 and 80 degrees by conducting a regression analysis by the least square method in said general formula (1), provided that the second electron emission coefficient of its surface has two incident energies which satisfy the second electron emission coefficient $\delta = 1$ under the vertical incident conditions, and that when the larger energy of said two energies satisfying said condition $\delta = 1$ is referred to as a second cross-point energy, the secondary electron emission coefficients for the primary electrons whose incident angles are θ and 0 degrees are represented by

δ_θ, δ_0, respectively, and
m_1, m_2 have the values
$m_1 = 0.68273$
$m_2 = 0.86212$, respectively,

in the incident energy equal to or lower than the second cross-point energy."

The apparatus and spacer recited in Claims 1 and 27, respectively, are characterized by making a relaxed "dependency" of a secondary electron emission coefficient upon an incident angle.

The admitted prior art (pages 7-8 and Fig. 36 of the present application) refers to a display panel having a planar image display, shown in Fig. 36. Fig. 36 shows a rear plate 3115, a side wall 3116, and a face plate 3117, which collectively form an outer enclosure. A substrate 3111 is fixed to the rear plate 3115, and N x M cold cathode devices are formed on the substrate 3111. The N X M cold cathode devices 3112 are wired with M lines of row wirings 3113 and N lines of column wirings 3114. An insulating layer

is formed between wirings 3113 and 3114. Page 23 refers to a general formula (1) in which an incident angle dependency of secondary electron emission coefficient and a vertical incidence of 0 degree can be used to evaluate the secondary electron emission multiplication effect at an angle. At page 24, lines 15-20 of the application, reference is made to antistatic films having an incident angle multiplication coefficient of secondary electron emission coefficient m_0 larger than 10, provided that the incident energy having a positive secondary electron emission coefficient is 1 KeV. However, as the Office Action concedes, the admitted prior art does not teach or suggest "the value of the parameter m_0 being 10 or less, determined by conducting a regression analysis by the least square method using 20, 40, 60 and 80 degrees for values of incident angle θ in the general formula".

According to the Office Action, Alderson refers to a fluting having a plane parallel to a cathode structure, formed at a side of a spacer, thereby suppressing a secondary electron emission quantity. However, in Applicants' view, Alderson is not seen to teach or suggest relaxing a "dependency" upon an incident angle, as is achieved by the apparatus of Claim 1 and the spacer of Claim 27.

More particularly, in Applicants' view, the unevenness (fluting) on a spacer side surface is referred to at col. 7, line 27 through col. 8, line 20 of Alderson, and col. 7, lines 39-40 state that "[t]he fluting reduces secondary electron emissions in three ways." First, as described beginning from col. 7, line 42, "[a] number of these impinging electrons will strike the surface at oblique angles. . . . the flutings increase the probability that secondary electrons will impinge upon the surface at or nearly at right angles, reducing the number of secondary electrons emitted as a result of the impacts." Second, as described beginning at col. 7, line 51, "the alteration of the orientation of the surface of the support

structure to the field lines of the electrostatic field allows the fluting to act as a trap for secondary electrons." Third, and as described at col. 8, lines 12-14, "the flutings act to reduce the number of hops a secondary electron and its progeny will make across the surface of the support structure toward the anode." Thus, according to Alderson, first there would be large number of electrons incident in an inclined direction relative to a side of the spacer, and the fluting is to set the electron incident direction vertical, thereby suppressing the secondary electron emission quantity. Second, since most of the emitted secondary electrons are directed again toward an anode, the secondary electrons are trapped within the fluting, thereby suppressing total secondary electron emission quantity. Third, repeated incidence of the secondary electron is suppressed, thereby reducing an avalanche multiplication of the secondary emission of the electron.

However, in Applicants' view, even if Alderson be deemed to refer to suppressing the secondary electron emission, nothing has been found, or pointed out, in that reference which would teach or suggest the spacial spacer surface performance of the present invention, wherein the incident angle θ dependency of the quantity of secondary emitted electron incident at a particular angle normalized by a secondary emitted electron incident in a vertical direction is relaxed. That is, while according to Alderson it may be possible to suppress the secondary emitted electron quantity $\delta 0$ under a vertical incident condition together with $\delta\theta$, in such a case it is not certain that $\delta\theta/\delta 0$ is necessarily reduced. Accordingly, Alderson does not necessarily disclose or suggest the image forming apparatus having such spacer having a surface of which θ dependency, i.e., $\delta\theta/\delta 0$, is suppressed.

For these reasons, Applicants respectfully submit that neither the admitted prior art nor Alderson teach or suggest an apparatus and spacer having the above-mentioned features of Claims 1 and 27, respectively, and therefore Claims 1 and 27 are each deemed clearly patentable over the admitted prior art and Alderson, whether considered separately or in combination.

The rejection of independent Claim 26 will now be addressed.

Claim 26 recites an electron beam apparatus comprising a hermetic container which includes an electron source having electron emission devices and targets exposed to the electrons emitted from the electron source and further comprising a first member within the hermetic container. The first member has a film on its surface, the foundation of the film has an uneven geometry, and the thickness of the film is smaller than the height difference between the top and lowest portions of the uneven geometry of the foundation.

The admitted prior art and the teachings of Alderson were discussed above.

Mitsutake et al. refers to a substrate 11 on which a plurality of electroconductive films for producing electron-emitting regions are arranged and wired to form a matrix. A semiconductor thin film 20b of tin oxide is formed on surfaces of the insulating member 20a of soda lime glass of column-shaped spacers 20(height: 5 mm, diameter: 100 μm) that had been exposed to an inside of an envelope. The spacers 20 were secured on the substrate 11 on respective row-directed wirings 13 at regular intervals, and a face plate 17 carrying a fluorescent film 18 and a metal back 19 was arranged above the substrate 11 with lateral walls 16 disposed therebetween.

However, Applicants respectfully submit that, even if the admitted prior art, Alderson, and Mitsutake et al. be deemed to teach the relevant features discussed above, nothing in any of those references would teach or suggest a first member having a film on its surface, wherein the foundation of the film has an uneven geometry, and the thickness of the film is smaller than the height difference between the top and lowest portions of the uneven geometry of the foundation, as recited in Claim 26.

Moreover, although the Office Action asserts that "it would have been obvious to one of ordinary skill in the art . . . to have the surface of the spacer with uneven geometry be coated with the semiconductor thin film with thickness or 0.1 μm, smaller than the average roughness of the surface to reduce the problem of secondary emission along the surface", Alderson is not seen to teach or suggest a size of the uneven geometry (concave or convex), and the prior art relied on by the Examiner to reject Claim 26 is not seen to teach or suggest the relationship between the amplitude (height difference between top and lowest portions of an uneven geometry), the uneven geometry, and the thickness of the film formed thereon, as recited in Claim 26. Furthermore, the Office Action is not seen to specifically point out which prior art reference(s) the Examiner apparently believes would teach such a relationship, and thus Applicants submit that the Office Action fails to establish a *prima facie* case of obviousness against Claim 26. "To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art." MPEP § 2143.03 (citing *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)).

For these reasons, it is believed that the Section 103 rejection of Claim 26 has been obviated, and its withdrawal is therefore respectfully requested.

Added independent Claims 43 and 46 recite features similar to those discussed above with respect to Claims 1 and 27, respectively, but further recite that the first member is provided with an uneven geometry at least on a part of its surface, wherein the uneven geometry is arranged at least in two directions on the surface. Added Claim 49 also recites these features regarding the first member. Support for those recitations is found in the originally filed specification, at least at page 41, line 10. For the reasons given above in connection with Claims 1 and 27, Claims 43 and 46 are believed to be patentable over the prior art relied on by the Examiner. Those claims and added Claim 49 also are believed patentable over that art for the reason that none of the prior art references relied on by the Examiner is seen to teach or suggest a first member provided with an uneven geometry at least on a part of its surface, wherein the uneven geometry is arranged at least in two directions on the surface, as recited in Claims 43, 46, and 49.

Added independent Claims 44 and 47 also recite features similar to those discussed above with respect to Claims 1, and 27, respectively, but further recite that the first member is provided with an uneven geometry at least on a part of its surface, wherein the uneven geometry is constituted of the amplitudes of at least two kinds of unevenness. Added Claim 50 also recites these features regarding the first member. Support for those recitations is found in the originally filed specification, at least beginning at page 60, line 21. For the reasons given above in connection with Claims 1 and 27, Claims 44 and 47 are believed to be patentable over the prior art relied on by the Examiner. Those claims and added Claim 50 also are believed patentable over that art for the reason that none of the prior art references relied on by the Examiner is seen to teach or suggest a first member provided with an uneven geometry at least on a part of its surface, wherein the uneven

geometry is constituted of the amplitudes of at least two kinds of unevenness uneven Claims 44, 47, and 50.

Added independent Claims 45 and 48 also recite features similar to those discussed above with respect to Claims 1, 27, and 1, respectively, but further recite that the first member is provided with an uneven geometry at least on a part of its surface, wherein the uneven geometry is constituted of the cycles periods of at least two kinds of unevenness. Added Claim 51 also recites these features regarding the first member. Support for those recitations is found in the originally filed specification, at least on page 60 and original Claim 10. For the reasons given above in connection with Claims 1 and 27, Claims 45 and 48 are believed to be patentable over the prior art relied on by the Examiner. Those claims and added Claim 51 also are believed patentable over that art for the reason that none of the prior art references relied on by the Examiner is seen to teach or suggest a first member provided with an uneven geometry at least on a part of its surface, wherein the uneven geometry is constituted of the cycles periods of at least two kinds of unevenness, as recited in Claims 45, 48, and 51.

A review of the other art of record has failed to reveal anything which, in Applicants' opinion, would remedy the deficiencies of the art discussed above, as references against the independent claims herein. Those claims are therefore believed patentable over the art of record.

The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of

the invention, however, the individual consideration or reconsideration, as the case may be, of the patentability of each on its own merits is respectfully requested.

In this regard, Applicants note that the filing date of Smith et al. (December 11, 1998) is later than the filing date (October 7, 1998) of priority document JP10-285759, upon which the present application claims benefit of priority. The issue date (April 24, 2001) of Smith et al. also postdates the filing date (October 7, 1999) of the present application. Accordingly, Smith et al. does not qualify as prior art under 35 U.S.C. 102 or 35 U.S.C. 103, against the claims of the present application, and thus withdrawal of the rejection set forth in the Office Action based on Smith et al. is respectfully requested. A sworn translation of document JP10-285759 is presently being prepared, and shall be forwarded to the Patent and Trademark Office shortly.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO SPECIFICATION

The paragraph appearing at page 29, lines 10-19 has been amended as follows.

What should be done to reduce incident angle multiplication coefficient of secondary electron emission coefficient m_0 as well as to reduce secondary electron emission coefficient [δ0] δ_0 for the vertical impedance? After the present inventors' detailed examination, it was found that the above subject can be accomplished by satisfying the following requirements. Specifically, it is considered that the methods grouped into two major categories can be used in order to relax incident angle dependency.

The paragraph starting at page 37, line 19 and ending at page 38, line 25 has been amended as follows.

The measurement of the second electron emission coefficient and the determination of the incident angle multiplication coefficient of secondary electron emission coefficient m_0 are carried out as described below. First, for the measurement of [second] secondary electron emission coefficient, a general-purpose scanning electron microscope (SEM) equipped with an electronic ammeter is used. For the measurement of primary electron current, Faraday cup is used. The amount of the [second] secondary electron current is defined using a detector with collectors (for example, MCP or the like is available). Alternatively, it may be

obtained from the [data] specimen current and the primary electron current using the relationships of continuous law of the [data] specimen current passing through the [data] specimen portion, the primary current and the secondary current. Incident angle multiplication coefficient of secondary electron emission coefficient m_0 can be obtained by conducting the measurement at an incident angle of 0 and at an incident angle of other than 0 under the same incident energy conditions. It is a particularly good way to define different incident angles as a 0-δ property and perform regression analysis (fitting) in general formula (1) by the least square method. In this patent application, the above fitting was performed using the secondary device emission coefficients measured at an incident angle of 0, 20, 40, 60 and 80 degrees. As a spot diameter, when the first member has an uneven structure, the size is employed which is larger than the pitch of the unevenness, in particular, which makes it possible to simultaneously expose two cycles or more of unevenness to electrons. The measurement was conducted at a vacuum of 10^{-7} Torr (1.3×10^{-5} Pa) or lower at room temperature (20°C).

The paragraph appearing from page 39, line 21 to page 40, line 5 has been amended as follows.

Here, the thickness of the film on the uneven part of the substrate is measured in the following manner. That is to say, a section is made by cutting off the film perpendicular to the surface of the spacer and exposed. The thickness can be measured at the above section by the section SEM. The film thickness to be measured shall be that of the lowest portion of the concavity on the substrate. When evaluating the thickness by the section SEM, a metal film

deposited by sputtering may be provided as a pretreatment. This allows the local charge-up due to the insulating property of the [data] <u>specimen</u> to be restricted.

The paragraph appearing from page 65, line 19 to page 66, line 2 has been amended as follows.

Thus, the resistance value Rs of the spacer is set for a value within the range desirable in terms of its [antistatoc] <u>antistatic</u> effect and power consumption. In terms of the antistatic effect, preferably the sheet resistivity R/□ is 10^{14} Ω/□ or lower. In order to obtain a sufficient antistatic effect, it is more preferable that the sheet resistivity R/□ is 10^{13} Ω/□ or lower. Although the sheet resistivity is dependent on the shape of the spacer and the voltage applied between the spacers, preferably it is 10^{7} Ω/□ or higher.

The paragraph appearing from page 66, line 24 to page 67, line 12 has been amended as follows.

As described above, the temperature of the spacer rises when current flows through the antistatic film formed thereon or when the entire display generates heat during its operation. If the antistatic film has a temperature coefficient of resistance which is significantly negative, its resistance value decreases with temperature increase, which leads to increase in the current flowing through the spacer, and hence increase in temperature. And the current continues to rise till the power source reaches its limits. Empirically, the values of temperature coefficient

of resistance at which such a thermal runaway takes place are negative and their absolute values are 1 % or larger. In other words, it is preferable that the temperature coefficient of resistance of the antistatic film is [less] more than -1 %.

The paragraph appearing at page 68, lines 6-16 has been amended as follows.

The nitrides of aluminum-transition metal alloy are suitable materials because their resistance values can be controlled over a wide range from a good conductor to an insulating material by adjusting the composition of the transition metal. In addition, since their resistance values change only a little in the production process of an image display described below, they are stable materials. Further, since their temperature coefficients of resistance are [less] more than -1 %, they are easy to practically use. The above transition metals include, for example, Ti, Cr and Ta.

The paragraph appearing from page 79, line 19 to page 80, line 3 has been amended as follows.

As described above, the nitrides of aluminum-transition metal alloy are suitable materials because their resistance values can be controlled over a wide range from a good conductor to an insulating material by adjusting the composition of the transition metal. In addition, since their resistance values change only a little in the production process of an image display described below, they are stable materials. Further, since their temperature coefficients

of resistance are [less] <u>more</u> than -1 %, they are easy to practically use. The above transition metals include, for example, Ti, Cr and Ta.

The Abstract appearing at page 148, lines 2-25 has been deleted and replaced with a substitute Abstract.

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